

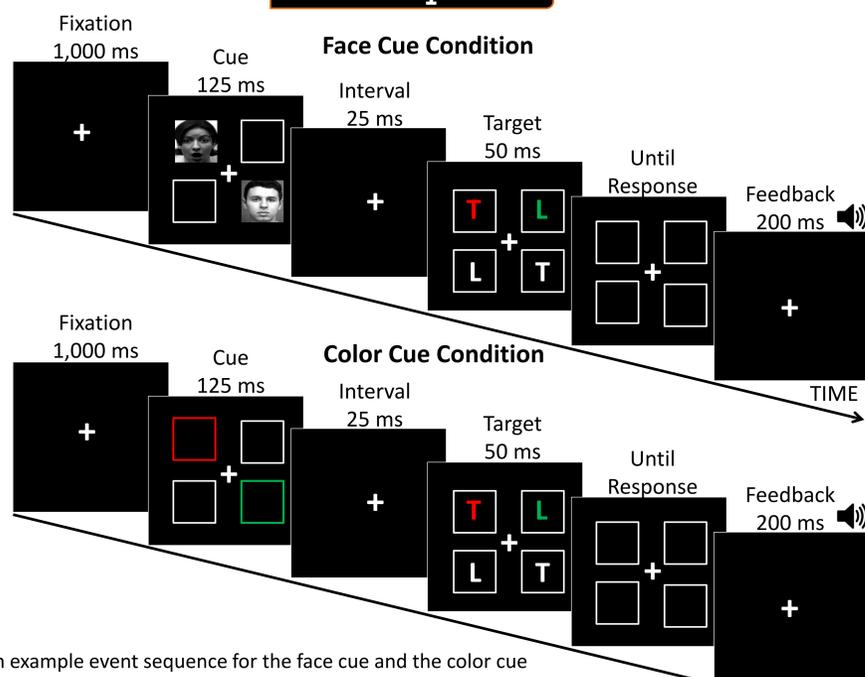
Robinson Taylor & Mei-Ching Lien  
Department of Psychology, Oregon State University

## Introduction

Stimuli signaling threat are often processed especially rapidly (e.g., Fox, Russo, & Dutton, 2002). Similarly, some studies have suggested that expressions of fear have a strong pull on our attention because they signal threat (e.g., Phelps, Ling, & Carrasco, 2006; Shaw, Lien, Ruthruff, & Allen, in press; Vuilleumier & Schwartz, 2001). These stimuli, however, were typically relevant to the task (i.e., were targets). The present study questioned whether fearful facial expressions capture attention involuntarily (i.e., automatically) even when they are irrelevant.

A cuing paradigm was used in the present study. Participants were instructed to search the target display for a pre-specified target object, which was either a letter in a specific color (Exp. 1) or a face with a specific emotional expression (Exps. 1-5). The target display was always preceded by a non-informative cue display, which could contain a fearful face and/or a neutral face. The face could appear in the same location as the upcoming target ("valid" trials; 25% of the trials) or in a different location ("invalid" trials; 75% of the trials). The critical measure of attentional capture is the *cue validity effect* (Invalid minus valid) on response time (RT) and Proportion error (PE).

## Trial Sequence

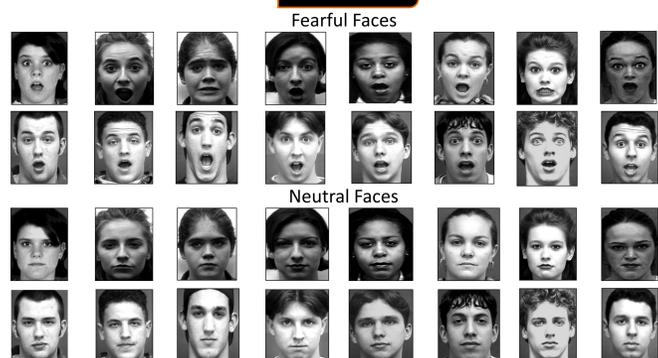


An example event sequence for the face cue and the color cue condition in Experiment 1. In this example, the target was a red letter. Thus, in the face cue condition, the fearful face cue was valid and the neutral face cue was invalid. In the color cue condition, the red box cue was valid and the green box cue was invalid.

## Predictions

As in previous cuing studies, we expected to obtain a cue validity effect for the box cue with the same color as the target (the 'target color cue'), indicating attention capture. The main question is whether fearful faces would also capture attention and produce a cue validity effect of a similar magnitude.

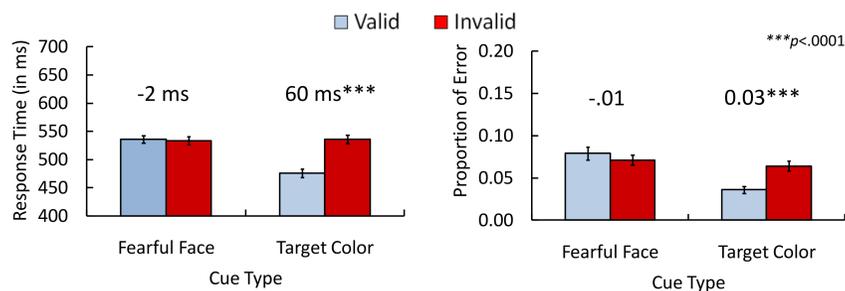
## Stimuli



## Experiment 1 (N=52)

**Purpose:** Examine whether fearful faces capture attention involuntarily, even when people are not looking for faces.  
**Task:** Half of the participants responded to the red letter and the other half to the green letter. They pressed the key labeled "L" for the target letter L and the key labeled "T" for the target letter T.  
**Cues:** Face cues (fearful vs. neutral) and color cues (red vs. green) were intermixed within blocks.  
**Face Stimuli:** 16 fearful faces (8 males and 8 females) and 16 neutral faces (8 males and 8 females)

## Results and Discussion

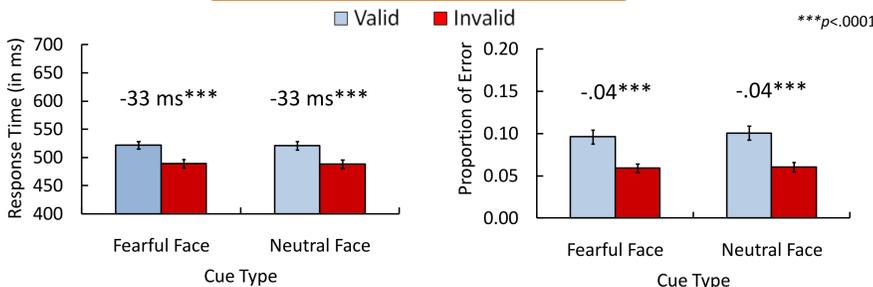


As predicted, the target color cue produced cue validity effects on RT and PE,  $F_{s(1,50)} \geq 33.36$ ,  $p < .0001$ . In contrast, the fearful face did not produce cue validity effects on RT and PE,  $F_{s(1,50)} \leq 2.04$ ,  $p \geq .16$ .

## Experiment 2 (N=48)

Experiment 1 revealed that color cues captured attention involuntarily, while fearful faces did not. Because two faces appeared simultaneously in the cue display, the fearful face had to compete against the neutral face for processing resources, perhaps weakening any attention capture. Experiment 2 addressed this issue by presenting only one face (fearful or neutral) in the cue display. Having already demonstrated that target color cues capture attention, this experiment focused exclusively on face cues.

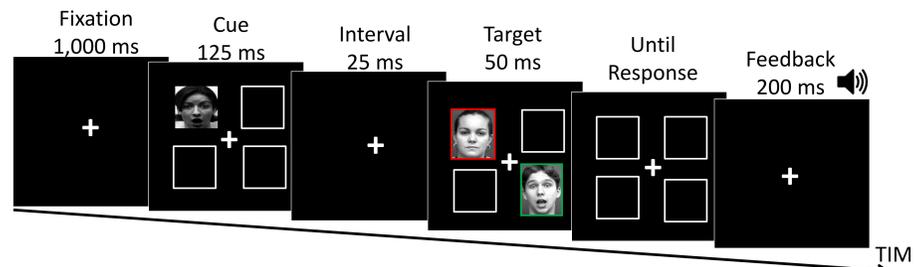
## Results and Discussion



Fearful and neutral faces actually impaired the processing of a target appearing in that location (i.e., in the valid condition);  $F_{s(1,46)} \geq 45.78$ ,  $p < .0001$ , for both RT and PE. This indicates that any benefit of attentional capture in the valid cue condition was outweighed by the cost of forward masking by the face. Even more critically, there was no effect of the emotional expression (fearful vs. neutral).

## Experiment 3 (N=60) and Experiment 4 (92)

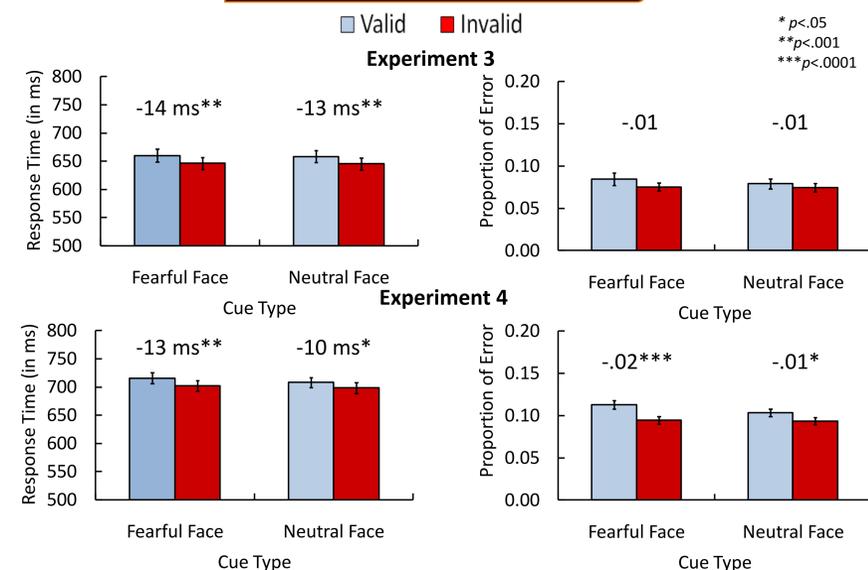
The absence of capture by fearful faces in Experiments 1 and 2 could be because faces were not task-relevant. Perhaps fearful faces capture attention only when people are searching for faces. Therefore, Experiment 3 used a gender task and Experiment 4 used an emotion task. Two faces (always a different gender and emotion) were presented inside colored boxes (red vs. green) and in opposite hemifields of the target display. The faces in the cue and target displays were always different.



**Experiment 3 (A gender task)** – Half of the participants responded to the gender of the picture within the red box and the other half to the gender of the picture within the green box.

**Experiment 4 (An emotion task)** – Half of the participants responded to the emotion of the picture within the red box and the other half to the emotion of the picture within the green box.

## Results and Discussion

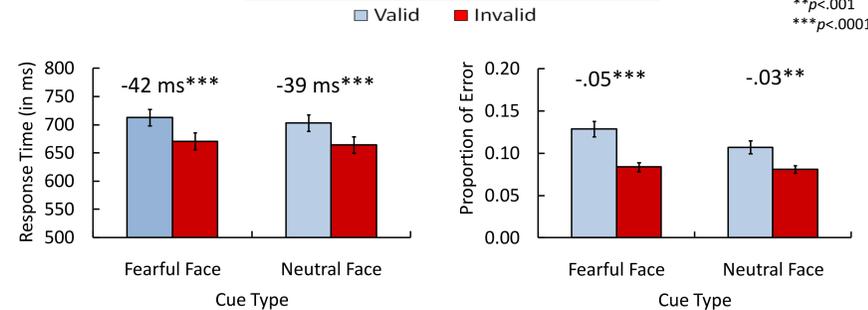


As in Experiment 2, fearful and neutral faces impaired the processing of a target for the valid condition in Experiment 3 [RT],  $F_{s(1,58)} \geq 13.26$ ,  $p < .001$ , and Experiment 4 [RT & PE],  $F_{s(1,90)} \geq 6.08$ ,  $p < .05$ . The effect was similar for these two types of face cues in both experiments,  $F_{s} < 1.0$ . Thus, fearful faces do not capture attention even when people were set to look for faces. There was, however, a significant trend towards overall slowness (8 ms longer) and more errors (.01 higher) following a fearful face,  $F_{s(1,90)} \geq 5.16$ ,  $p < .05$ .

## Experiment 5 (N=40)

Experiment 5 replicated Experiment 4 but increased the likelihood of capture by face cues by doubling the duration of the cue display (125 ms to 250 ms), as well as the interval between the cue and target display (25 ms to 50 ms).

## Results and Discussion



The results replicated those of Exps 2-4. Both fearful and neutral faces impaired the processing of a target in the valid condition on RT and PE,  $F_{s(1,38)} \geq 16.05$ ,  $p < .001$ . The effect was similar for these two types of face cues on both RT and PE,  $F_{s} < 1.0$ . The only effect of emotion type was an overall slowing (10 ms) and more errors (.022) following a fearful face cue,  $F_{s(1,38)} \geq 4.19$ ,  $p < .05$ .

## General Discussion

We examined whether fearful faces capture attention involuntarily (i.e., automatically) using a cuing paradigm. We found no evidence that fearful cues captured attention to their location, speeding target responses on valid trials and slowing target responses on invalid trials. However, when participants were looking for faces, fearful faces did produce an overall impairment of target processing regardless of its location. We conclude that fearful faces can be distracting, but do not generally have the inherent power to capture attention against our will.

## References

Fox, E., Russo, R., & Dutton, K. (2002). Attentional bias for threat: Evidence for delayed disengagement from emotional faces. *Cognition and Emotion*, 16, 355-379.  
Shaw, K., Lien, M.-C., Ruthruff, E., & Allen, P. A. (in press). Electrophysiological evidence of emotion perception without central attention. *Journal of Cognitive Psychology*.  
Phelps, E. A., Ling, S., & Carrasco, M. (2006). Emotion facilitates perception and potentiates the perceptual benefits of attention. *Psychological Science*, 17, 292-299.  
Vuilleumier, P., & Schwartz, S. (2001). Emotional facial expressions capture attention. *Neurology*, 56, 153-158.